The Arrow-Lind Theorem Revisited: Ownership Concentration and Valuation

Bednarek, Ziemowit and Moszoro, Marian

California Polytechnic State University, Orfalea College of Business, SGH Warsaw School of Economics

March 2014

The Arrow-Lind Theorem Revisited: Ownership Concentration and Valuation

Ziemowit Bednarek and Marian Moszoro*

March 2014

Applied Financial Economics [merged into *Applied Economics*] 24(5): 357–375

Abstract

According to Arrow and Lind (1970), the more shareholders participate in an investment and the more dispersed the ownership structure becomes, the lower the discount rate of an individual investor is due to risk sharing. This implies that the valuation of the investment should increase. Employing a dataset of investor-level ownership records, asset pricing measures, and managerial discretion proxies, we test Arrow and Lind's hypothesis of the relationship between ownership concentration and risk premium, and its implication for company valuation. We find that: (i) contrary to previous studies on institutional ownership, greater ownership dispersion is associated with higher company valuation and (ii) managers are more likely to invest in fixed assets and hold less cash in companies with dispersed ownership. Our results remain robust after controlling for liquidity and governance by several measures. We argue that both results are interconnected: when ownership concentration is low, investors' lower premiums and managers' risk-neutral behavior contribute to higher valuations.

JEL Classification: G12, G32, G34

Keywords: Arrow-Lind Theorem, Ownership Structure, Risk Sharing, Firm Value, Corporate Governance

*Bednarek: California Polytechnic State University, Orfalea College of Business, 1 Grand Ave, San Luis Obispo, CA 93422, United States, zbednare@calpoly.edu. Moszoro: Haas School of Business, University of California, Berkeley and Kozminski University, Warsaw; mmoszoro@cal.berkeley.edu; Institute for Business Innovation (IBI), F402 Haas School of Business, Berkeley, CA 94720. This research received financial support from Orfalea College of Business Summer Research Grant, IESE's Public-Private Sector Research Center and Center for International Finance. Wharton Research Data Services (WRDS) was used in preparing this paper. This service and the data available thereon constitute valuable intellectual property and trade secrets of WRDS and/or its third-party suppliers. We thank seminar participants at the University of Navarra (Econ) and IESE Business School as well as discussants at 2013 International Society for New Institutional Economics Meeting and 2013 European Financial Management Association Meeting for comments. We are particularly indebted to Alberto Marconi for an extensive review of this paper. All errors are our own.

1 Introduction

We study the link between firm valuation and institutional ownership concentration, with reference to the seminal Arrow and Lind (1970) (AL) paper. Contrary to previous studies, we find that lower ownership concentration is related to higher price-to-earnings (P/E) ratios, controlling for a series of firm characteristics. The theoretical motivation for our study stems from the valuation equation: firm value is a function of cash flows to equity, growth of these cash flows, and equity cost of capital. It is the equity cost of capital that will be of crucial importance to the valuation. Ownership concentration should affect the value of the firm. Suppose arguendo, that firm A is owned by one shareholder and firm B is owned by 1,000 shareholders, each with equal share. We will further assume that the managers act in the best interest of the shareholders. The manager of firm A will be extremely risk averse, as the owner of the company is risk averse. There is no risk sharing with other shareholders. The manager of firm B will be much less risk averse, since the more shareholders own firm B, the less risk averse they are. In both cases of firms A and B, the ownership structure will affect the projects that each firm will undertake, and therefore their values.

Scant research has focused on the relationship between ownership concentration, risk perception, and valuation. Previous studies concentrated on management (insider) ownership and institutional breadth. In a 1980 cross-section of 371 large Fortune 500 firms, Morck, Shleifer, and Vishny (1988) found evidence that the relationship between management ownership and market valuation of firms behaves non-monotonically: valuation increases, then declines, and then rises slightly as insider ownership rises. Based on the data from mutual fund holdings, Chen, Hong, and Stein (2002) showed that low breadth—i.e., when few investors have long positions—signals that prices are high relative to fundamentals. Cho (1998) showed that corporate value impacts ownership structure, but not vice versa, and put into question the assumption that ownership structure is exogenously determined. Our results contradict these findings as we show that higher concentration of institutional corporate ownership (or lower ownership breadth) leads to lower P/E ratios.

AL studied the effect of the dispersion in the shareholder structure on the risk perception of company's cash flows. As the number of the shareholders grows, so does the risk sharing, which in turn implies that the cash flows generated by the firm should be discounted at a lower

rate. The extreme case is when the company is owned by the government, by construction representing an infinitely large number of shareholders each holding a small fraction of the company. AL show that in this case, from an investor's perspective, a discount rate equal to the risk-free rate should be applied.

Assuming identical cash flows between two investments, one with a dispersed shareholder base and the other with a concentrated shareholder base, the value of the company should be higher in the case of the firm with low ownership concentration due to the lower aggregate risk premium. This argument shows why it will be convenient for us to work with P/E ratios. We will be comparing the price per share, holding earning per share constant, hence the P/E ratio. In other words, assuming that the simple dividend growth model holds, this is equivalent to comparing an inverse of the discount rate minus the growth rate of earnings:

$$P_t = \frac{D_{t+1}}{r_E - g} \rightarrow \frac{P_t}{E_{t+1}} = \frac{d}{r_E - g}, \tag{1}$$

where r_E is the equity cost of capital, D_t is the dividend, d is a constant dividend payout ratio and g is the growth rate of earnings.

Following AL insights, in order to study the effect of the institutional ownership concentration on the company value, we postulate that the equity cost of capital should contain a component related to the dispersion of the shareholder base. We therefore transform the theoretical relationship in (1) between the P/E ratio, return on equity, and the growth rate, by adding a measure of concentration (based on the Herfindahl-Hirschmann Index).

We use Thomson Reuters for the institutional ownership data. Each institutional shareholder with a value of assets over $100 million is subject to rule 13f, under which it files information on its holdings exceeding 10,000 shares or valued at $200 thousand or more. We use Compustat quarterly dataset for all other accounting data, and CRSP to calculate monthly CAPM betas in order to estimate the time-varying equity cost of capital. We rely on the I/B/E/S for earnings' forecasts to find forward-looking P/E ratios. We also work with three other measures of the P/E ratio: unlevered P/E ratio, 12-month trailing P/E ratio, and Shiller's 10-year P/E ratio. Results using all four measures are consistent.

In our empirical specification, we first employ panel data regressions with year and industry fixed effects and find a statistically significant relationship between the P/E ratios and ownership concentration. The effect is significant for all measures of the P/E ratio. The

effect of the ownership concentration is economically significant as well. A 1% increase in the contemporaneous level of ownership concentration causes a drop in the P/E ratio of between 2% and 7% depending on which measure of the P/E is considered.

In several different regression specifications we allow the possibility of endogeneity between firm valuation and ownership concentration, and show the results are robust to that consideration. Using the instrumental variables approach, we employ the lagged values of ownership concentration, the number of analysts' forecasts, trading volume, and stock price volatility as instrumental variables. The last two instruments are the main drivers of the institutional demand for stocks.

After establishing the relationship between firm valuation and ownership concentration, we show that the results is not related to the two possible explanations: stock liquidity and corporate governance. We confirm a well-known stylized fact that lower ownership concentration leads to a higher liquidity, as measured by the trading volume, stock price volatility, and bid-ask spreads. This suggests the following research question: Is the effect of ownership concentration in fact related to stock liquidity? Using the residuals from the regression of ownership concentration on liquidity measures we determine the fraction of ownership concentration not related to liquidity and use that as the measure of concentration. We obtain negative coefficients on the liquidity residuals. This suggests our results are not driven by liquidity effects alone. Next, we control for the Corporate Governance Index (G) of Gompers, Ishii, and Metrick (2003), which is high for companies in which managers have more discretion and low in companies where the corporate governance style is more democratic. The effect of the ownership concentration on the P/E ratios is present after controlling for G.

Finally, we analyze the relationship between managerial discretion proxies and ownership concentration. According to AL, low ownership concentration implies that the risk sharing among shareholders increases and individual risks are low. This leaves the managers of the company—assuming they are acting in the interest of the shareholders—more discretion as to what investments to pick as the hurdle rate is relatively low. Further, as the shareholders' risk sharing increases, the manager may act risk-neutral and only maximize the expected return, irrespective of the risks involved.

We find that the direction of the relationship between the ownership concentration and the managerial discretion proxies is consistent with Arrow-Lind theorem and our expectations. In firms with a more dispersed shareholder structure, gross value of fixed assets grows faster (or equivalently, more is invested in fixed assets), and cash constitutes a lower fraction of the balance sheet sum as more of it is spent, a higher fraction of the net income goes towards capital expenditures and research and development. All these findings seem to confirm that when the ownership concentration is low, the cost of risk-bearing is minimal, and therefore maximizing expected return whatever the risk, is the objective of the manager acting in the best interest of the shareholders.

2 Ownership Concentration, Risk Premium, and Valuation

In this section we lay out the theoretical channels of interactions between shareholder dispersion, discount rates and firm valuation. We also present the theoretical model that this paper is testing. According to the Arrow-Lind theorem, "as the net returns of an investment of a given size are shared by increasingly many individuals, the risk premium for the respective individuals vanishes and, more importantly and perhaps surprisingly, the aggregate of these premiums for all individuals also approaches zero" (Fisher 1973, 772).

On a side note, Arrow and Lind commented that "if each stockholder's share in the firm is a small component of his income, the cost of risk-bearing to him will be very small" (AL, 376).[1] It then follows that "if managers were acting in the interest of the firm's shareholders, they would essentially ignore risks and choose investments with the highest expected returns" (AL, 376). Thus according to AL, the more dispersed the shareholder structure is, the more risk neutral managers should behave.

On the one hand, shareholders with small stakes in companies value them at a lower risk premium and, on the other hand, managers in companies with less concentrated ownership enjoy more discretion and are less risk averse in selecting projects. Therefore, we identify the following channels of interaction between the ownership concentration and corporate valuation:

[1] Arrow and Lind's (1970) paper was focused on the social discount rate and public (governmental) investments, not corporate finance and asset pricing. Their comment on the applicability of the theorem to corporations was incidental.

(a) *Small individual stock positions, more stock liquidity* $\longrightarrow$ *lower premium, higher valuation*
Idiosyncratic events have lower impact on diversified portfolios: small stock positions are easier to trade without negatively impacting the market price. Thus, investors demand lower liquidity premium for firms with less concentrated ownership.

(b) *Small individual stock positions, more managerial discretion* $\longrightarrow$ *lower hurdle rate (required cutoff return), less idle cash holdings, more investment projects, higher valuation*
Managers who enjoy more discretion behave risk neutral: screen projects at a lower discount rate (invest more and more promptly) and hold less idle cash in companies with less concentrated ownership.

(c) *Investors' posteriors about lower managerial risk aversion* $\longrightarrow$ *higher valuation*
Investors in companies with dispersed ownership know managers behave risk neutral and value them accordingly.

Based on the above observations we formulate the following research hypotheses:

Hypothesis 1 *Lower ownership concentration leads to higher firm valuation.*

Hypothesis 2 *Lower ownership concentration leads to higher managerial discretion.*

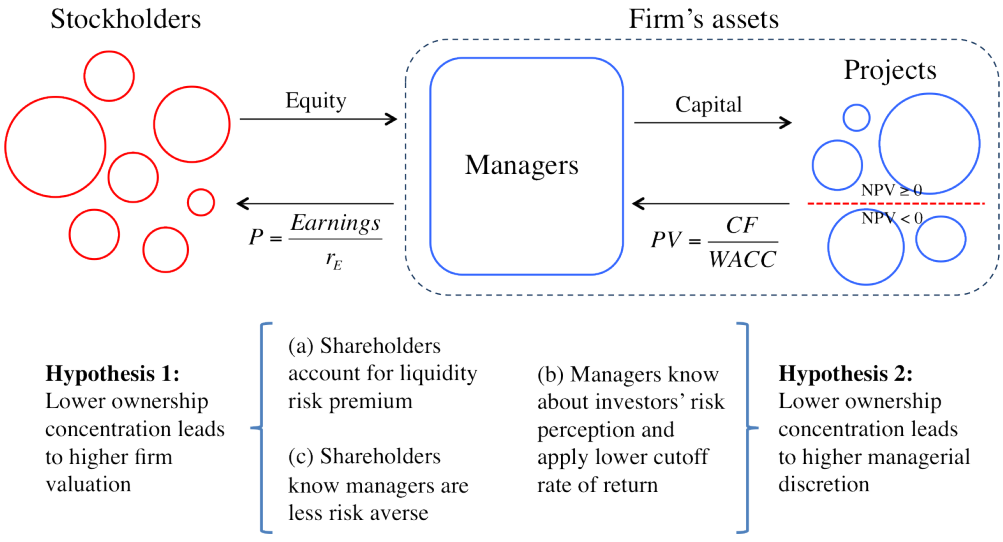


Figure 1: This figure presents the interaction of ownership concentration, managerial behavior, and firm valuation.

Figure 1 illustrates the interaction of ownership concentration, managerial behavior, and firm valuation implied by the Arrow-Lind theorem.

2.1 Base model

Our base model comes from the well known dividend discount model under Modigliani-Miller hypothesis of dividend irrelevance:

$$P_t = \frac{D_{t+1}}{r_E - g}, \tag{2}$$

where P_t is the current stock price, D_{t+1} denotes dividend per share expected at the end of next quarter, r_E is return on equity and g is the growth rate of earnings. If we rearrange equation (2) we obtain:

$$\frac{P_t}{E_{t+1}} = \frac{d}{r_E - g}, \tag{3}$$

where d is a constant dividend payout rate, and E_{t+1} is earnings per share. Equation (3) suggests that the theoretical relationship between P/E and return on equity should be negative: higher r_E will imply lower P/E ratio, all else equal; and positive relationship between the growth rate g and P/ E. Higher g implies higher P/E as next year's earnings growing at a higher rate will imply higher future earnings.

Since AL postulate that the equity cost of capital should be low in firms with low ownership concentration due to risk sharing, in our empirical specification we will augment (3) and express the discount rate as a function of the ownership concentration. Further, in order to properly study the effect of a company's ownership structure on its P/E ratio, we need to control for other variables as well. In particular, we hold constant firm's leverage ratio and size, as these characteristics have been shown in the literature to affect firm's valuation. Size is also an important factor attributed to P/E ratios, as in Jaffe, Keim and Westerfield (1989). Previous research indicates that two important factors affecting the variation of the company P/E ratios are growth and risk. Growth is traditionally measured as the change in net earnings, and market risk as the firm's beta. Therefore, if we make a claim that company risk is captured in the P/E ratio, we need to control for the effect of the earnings growth and beta. Company's beta is normally used to measure the systematic portion of cash flows' risk. We use P/E ratios as our main dependent variable instead for a simple reason. If we believe that the P/E ratio captures the company's present value, then it is determined by present

earnings and a discount rate containing both risk and expected growth. Thus, holding other things constant, we can estimate time-varying risk from P/E ratios.

3 Data and Empirical Results

In this section we show empirical evidence supporting the applicability of AL theorem to corporations. We demonstrate in our sample that firm value, as captured by P/E ratio, and managerial discretion proxies as measures of risk aversion are in part determined by a company's ownership concentration.

3.1 Empirical motivation

Figure (2) presents the empirical motivation for this study. Between 1980 and 2012, institutional investors (large investors over $100m in assets) became increasingly invested in companies, especially large ones. Bottom left panel of figure (2) presents evidence of this phenomenon. Median number of institutional investors per firm increased from around 50 in the early 1980s to around 150 in 2000s. At the same time, as expected, the median share owned by the institutional investors increased from around 20% to 60% (upper left panel). Median ownership concentration measured by the Herfindahl-Hirschmann index declined to around 0.1. Median stock holdings per an institutional investor fell substantially in the analyzed period as presented in the bottom right graph.

We present unconditional firm-level data on the Shiller P/E and ownership concentration in figure (3). Average P/E ratio is displayed as a function of the concentration measured with the Herfindahl index. The upper panel presents the data broken down by leverage quintiles, and the bottom panel by size quintiles. Both panels suggest there is a negative correlation between the P/E ratio and the ownership concentration. Using other three measures of the P/E ratio does not change the graphs qualitatively.

3.2 Data

The ownership data of the companies listed on the NYSE, AMEX, and Nasdaq, was obtained from Thomson Reuters Institutional (13f) Holdings database and Compustat. The sample period is 1980-2012, with quarterly data winsorized at 1% level to exclude outliers. We filtered out companies from the financial sector. Table (1) presents summary statistics of the

firms in the sample. Firm-quarter observations span from 24 to 189 thousand. The difference in the number of observations comes from source limitations. Table (2) shows the breakdown of the sample by the two-digit SIC code, and the total market values of companies by SIC code. There are 5,327 distinct companies in the base sample. Main SIC codes represented in the sample suggest we include a lot of hi-tech firms, manufacturing computers, biotech products, precision and communication equipment, etc. Crude oil extraction and electric services companies are the only non hi-tech firms in the top ten SIC codes.

We use four different measures of the P/E ratio: (1) trailing twelve months P/E ratio, defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent 12-month (four-quarter) period; (2) unlevered P/E ratio, trailing twelve months; (3) the Shiller P/E ratio, aka Cyclically-Adjusted Price Earnings ratio (CAPE) or Normalized P/E ratio, calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior ten-year trailing mean of inflation-adjusted earnings; (4) forward P/E ratio, using I/B/E/S consensus analyst forecast of earnings over the next year instead of net income.[2] On average, firms showed share price ranging from 12 to 20 times earnings, depending on the P/E ratio considered.

As proxies for managerial discretion, we utilize: gross fixed assets growth, cash holdings over assets, capital expenditures to lagged assets and R&D to lagged assets. The average firm grew 2% annually, had cash holdings of 1% of assets, could cover 1.8 times current liabilities with near-liquid assets, and had short-term debt equal to one third of long-term debt. On average, capital expenditures constituted 4% of assets, and R&D also 4% of total assets.

Any institutional investment manager who exercises discretion over $100 million or more is obligated to file form 13f, pursuant to Section 13(f) of the Securities Exchange Act of 1934. On average firms had six equivalent shareholders (inverse of HHI), 101 institutional owners who owned 41% of the shares. Only in 2% of the firms in the sample the top five investors had more than 50% of the shares and in 10% of the firms of the sample the top ten investors had more than 50% of the shares.

Our control variables show average assets equaled $3.7 billion, financed in one fifth with debt. Average non-weighted beta was 1.1 and calculated return on equity was 20%.

[2] Appendix A describes different measures of the P/E ratio used as the dependent variables.

3.3 Investors' Perspective: Value and Liquidity Risk Premium

We run panel data regressions with firm-level fixed effects and report standard errors corrected for heteroskedasticity and autocorrelation. Table (3) contains the results for the following specification:

$$\left(\frac{P}{E}\right)_{i,t} = a_0 + a_1 \mathrm{OC}_{i,t} + a_2 \mathrm{REquity}_{i,t} + a_3 \mathrm{Size}_{i,t} + a_4 \mathrm{Leverage}_{i,t} + a_5 \mathrm{g}_{i,t} + a_6 PC_{i,t} + e_{i,t}, \tag{4}$$

where P/E are different price to earnings ratios, i indicates a firm, t is time, $g_{i,t}$ is the earnings growth defined as $g_{i,t} \equiv \mathrm{EPS}_{i,t+1} - \mathrm{EPS}_{i,t}$,[3] $\mathrm{OC}_{i,t}$ is ownership concentration[4] defined as:

$$\mathrm{OC}_{i,t} = \log(\mathrm{HHI}_{i,t}), \tag{5}$$

where $\mathrm{HHI}_{i,t}$ is the Herfindahl-Hirschman Index defined as:

$$\mathrm{HHI}_{i,t} = \sum_{j=1}^{N_{i,t}} s_{i,t,j}^2. \tag{6}$$

$N_{i,t}$ is the number of owners of firm i's shares at time t and $s_{i,t,j}$ is the percentage ownership in company i at time t of owner j. $\mathrm{PC}_{i,t}$ is the portfolio concentration calculated as the mean portfolio Herfindahl-Hirschman Index for the firm's investors. We include year and industry effects. Cost of equity is calculated from the CAPM as:

$$r_E = r_f + \beta(\mathbf{E}r_m - r_f),$$

with CAPM betas calculated on a monthly basis, using rolling regressions over the previous 60 months and monthly stock and market returns.

[3] In the actual empirical specification, we include three lagged value of the earnings growth g: EPS_{t+1}/EPS_t, EPS_{t+2}/EPS_{t+1}, and EPS_{t+3}/EPS_{t+2}. We run the regression with four different measures of g: total cash flow growth, operating cash flow growth, EBIT growth, and finally earnings per share growth (excluding extraordinary income).

[4] We also tested other variables and measures related to the ownership structure as potential controls: the percentage of institutional ownership, the number of institutional investors, and top five (ten) voting power as a dummy variable equal to one if five (ten) largest institutional owners have over 50% of outstanding shares. The percentage of institutional ownership and number of institutional owners present similar explanatory power as the Herfindahl-Hirschman Index of ownership concentration. Top five voting power has no significance and top ten voting power has significance only when we use the Shiller P/E as the dependent variable. We thus dropped these variables from our analysis. See on-line supplement with detailed ancillary regressions data available at: http://moszoro.net/docs/A-L_paper_Supplement.pdf.

Table (3) demonstrates results of a panel data regression of firm-level P/E ratio on firm's controls, including earnings growth dynamics and assets. The regressions take into account fixed effects on the firm level. We report a strong and robust relationship between firm's ownership concentration, measured by the Herfindahl-Hirschman Index, and firm's valuation for all measures of P/E. Negative and statistically significant estimates of ownership concentration validate AL hypothesis and suggest lower idiosyncratic risk—a premium for liquidity—ownership dispersed. Lower and less significant forward P/E coefficients may point to the fact that analysts do not take into account ownership concentration for their forecasts.

All measures of P/E are also positively correlated with assets size and negatively correlated with leverage and return on equity based on calculated betas. Return on assets shows inconsistency of sign and significance in estimates, suggesting other channels of causality between return on assets and valuation. In unreported regressions, we also controlled for portfolio concentration, calculated as the mean portfolio HHI for the firm's investors. Portfolio concentration has no significant correlation with company valuation.

Following Morck, Shleifer, and Vishny (1988), we test for a non-monotonic relationship between ownership concentration and valuation, controlling for ownership concentration levels by quintiles. The results of the regression models are presented in panel A of table (5). When broken by quintiles, we find that OC has a significant impact on the company valuation only in the trailing and unlevered P/E middle quintiles, and Shiller P/E lower and middle quintiles. Therefore OC is a significant metric *between*, but not so *within* quintiles of ownership concentration.

This insight is further corroborated by testing the relationship between ownership concentration and valuation, during different time periods: 1980s, 1990s, 2000s, 2004-2007, and 2008-2011. The results of the regression models are presented in panel B of table (5). We find that ownership concentration had a significant impact on the company valuation in all periods (with the exception of the 1980s and 1990s for the forward P/E). After disentangling the financial pre-crisis years 2004-2007 and post-crisis years 2008-2011, concentration becomes significant for pre-crisis 2004-2007 forward P/E. A possible explanation points to the fact that analysts offloaded valuations during the crisis.

3.4 Alternative Ownership Measures

We test the relationship between the firm valuation and other measures of corporate ownership to verify the robustness of our results. Table (4) presents results of the same regression specification as in table (3), but with measures of ownership structure different than Herfindahl-Hirschmann Index. We use the following alternative measures of the ownership structure: number of institutional shareholders, institutional ownership (in %), top five voting power (a dummy variable equal to one if five largest shareholders have over 50% of votes), top ten voting power (defined analogously), and top five and top ten ownership (as % of shares outstanding). The last column of the table presents the correlation coefficient of a given alternative measure with the Herfindahl-Hirschmann Index. Most coefficients have signs consistent with table (3). The coefficient on the number of institutional shareholders is positive and significant for all four measures of the P/E ratio. Higher number of the shareholders will usually be associated with lower ownership concentration, and so the positive coefficient here is consistent with a negative coefficient on the actual OC. Higher institutional ownership as a percentage of shares outstanding has all positive signs and significant for the Shiller P/E. Institutional ownership is negatively correlated with the OC in our sample, and the coefficients are positive. Top five and top ten voting power dummies have negative signs and are significant for some of the use P/E measures despite a very low correlation with the OC. Top five and top ten ownership percentage is not significant.

3.5 Is This a Liquidity Effect?

One possible and obvious explanation for the relationship between the P/E ratios and ownership concentration is the effect of liquidity on the firm valuation. Higher stock liquidity measured by bid-ask spreads, trading volume, and stock price volatility should impact price relative to the fundamentals. We build on the literature initiated by Demsetz (1968) and followed by Amihud and Mendelson (1989) and Pastor and Stambaugh (2003) in studying the effect of stock liquidity on the corporate value. Demsetz (1968) points out that a larger number of shareholders causes a narrower bid-ask spread. We allow for endogeneity of the relationship between ownership structure, concentration ratios, and bid-ask spreads. We conduct the analysis in two steps. First, we study what drives the institutional demand for

stocks, expecting that liquidity and firm size are the main drivers. This way we can establish a link between ownership concentration and liquidity. It is a well-known stylized fact that institutional investors prefer large and liquid stocks.

Table (6) presents the results of the institutional demand regressions. We include the trading volume, stock price volatility, and firm's assets as controls. The dependent variables include: OC, number of institutional owners, institutional ownership as a percentage of shares outstanding, and top five owners voting power. Trading volume is the number of stocks traded in any given month and stock price volatility is the stock price standard deviation computed over a 36-month rolling window. Higher trading volume has a significant statistical and economic effect on both the number of institutional owners (positive) and ownership concentration (negative). Stock price volatility has a strong effect as well. Institutional investors tend to demand stocks where large price swings are not uncommon and which trade frequently. Firm size also has a substantial effect increasing the institutional demand for stocks, therefore increasing the number of shareholders and reducing the concentration.

Table (7) demonstrates results of the regressions of the P/E ratio on the residuals from the regressions in the previous table. The residuals contain information about the institutional ownership free from any liquidity related factors. If our earlier results are in fact caused by the liquidity effects, we do not expect to find any significance on the residuals. However, the coefficients on the residuals of the regression in table (6) have signs consistent with earlier results and statistically significant. The coefficients on residuals of OC are negative for all four measures of the P/E ratio, and on the residuals of the number of institutional owners are positive (except for the forward P/E). With that we rule out the possibility that our results so far are driven by the liquidity effects only.

3.6 Corporate Governance Index

We investigate a possibility that the effect of the ownership concentration on the firm valuation is related to the corporate governance. As one of the controls we introduce the Corporate Governance Index—developed in Gompers, Ishii, and Metrick (2003)—on the ownership concentration and firm valuation. The index, originally denoted by G, describes the number of limitations imposed upon the shareholders. It serves as a proxy for the level of shareholders rights at about 1,500 large listed firms in the 1990s. We merge the original firm-level gov-

ernance index dataset with our existing data as we suspect the index will be related to the ownership structure and therefore its concentration. The index data stretches from 1990 to 2006, and is somewhat limited as to the number of companies covered, and hence we lose some observations.

Why do we suspect the index should be related to the ownership concentration and our story in general? This is because high G means a "dictatorship" of managers. In high-G firms managers should have a large say in the investment strategy of the corporation. From the perspective of the risk-sharing story, this is consistent with a high-risk potential asset substitution setting, in which agency problems are exacerbated through the potential of managers engaging in risky investments.

On the other hand, low G implies a low number of restrictions on the shareholders and a "democratic" corporate governance model. Using the nomenclature of our article so far, low corporate governance index would be consistent with a dispersed decision making process and higher level of risk-sharing among all shareholders.

This underlines why controlling for the level of the corporate governance index G is essential in our setting. According to Arrow-Lind, if the ownership is largely dispersed, implying a low level of concentration and a lot of shareholders, the risk-sharing is such that the overall risk aversion is low and perhaps approaches the risk-neutral setting. However, if the managers in such a corporation are strong, implying a high level of G, investment risk is in fact very high. Analogously, in firms with a high level of concentration, according to Arrow-Lind theorem we should observe low levels of risk-sharing, and therefore investing in such corporations should be discounted with a higher discount rate. But if the index G is low, implying a more "democratic" corporate governance model, the effect of the high concentration will be somewhat subdued.

All else equal, the intuitive effect of the governance index level on the P/E ratio should reflect the above logic. With that, a positive shock to the level of G should reduce the valuation measured with the P/E ratio. Conversely, a lower level of G should increase the valuation of the company. Both these situations imply a negative coefficient of the corporate index level G when P/E ratio is the dependent variable.

Table (8) presents the summary statistics of ownership concentration, governance index,

and controls by ownership concentration rank. Table (9) presents results from panel data regressions of ownership concentration OC and the number of institutional owners on the governance index G and all other controls included in the previous regressions. Ownership concentration OC is negatively correlated with governance G: "dictatorial" governance (high G) is associated with low ownership concentration. I.e., when ownership concentration is low, managers enjoy greater discretion. Table (10) presents results of the regressions of the four different measures of P/E on the ownership concentration, level of the corporate governance index G, and all other controls included in the previous regressions as well. As expected, the coefficients on G are all negative, with three significant at the 5% level. The effect of ownership concentration remains negative (except for the forward measure) and highly significant. Ownership concentration and the governance index complement each other: it seems that ownership concentration has a strong explanatory power for past-looking P/E ratios, while the governance index has a stronger explanatory power for forward-looking P/E. It is worth mentioning that the overall R^2 from the regressions increases significantly, reaching 22% for the forward-looking measure of P/E.

We apply the augmented Durbin-Wu-Hausman test suggested by Davidson and MacKinnon (1993) to investigate the possibility of an endogenous relationship between the P/E and G, and reject this hypothesis.

3.7 Endogeneity

In this article we study the relationship between ownership concentration, or more generally ownership structure, and company valuation. This relationship has been shown to be endogenous in previous literature. One of our concerns is that the ownership structure, and consequently our concentration measure, is not exogenous. Demsetz and Lehn (1985) show evidence that ownership structure, investment, and value are in fact endogenous. With an ampler and more detailed database, we also check Cho's (1998) statement that corporate value affects ownership structure, but not vice versa. This would contradict our findings that ownership concentration has an effect on several measures of corporate value.

Panel data regressions presented in the earlier tables of this study assumed the ownership structure as given exogenously. We circumvent the problem of possible endogeneity between corporate ownership and value by using lagged values of regressors. We run a three-stage least

squares regression, where we assume the possibility of endogeneity between corporate valuation and ownership structure. Results are presented in table (11). The formal representation of the simultaneous equations is as follows:

$$\left(\frac{P}{E}\right)_{i,t} = a_0 + a_1 \mathrm{OC}_{i,t} + a_2 \mathrm{REquity}_{i,t} + a_3 \mathrm{Lev}_{i,t} + a_4 \mathrm{Size}_{i,t} + a_4 \mathrm{g}_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$\mathrm{OC}_{i,t} = b_0 + b_1 \left(\frac{P}{E}\right)_{i,t} + b_2 \mathrm{PriceVol}_{i,t} + b_3 \text{Trading Volume}_{i,t} + b_4 Size_{i,t} + \epsilon_{i,t}, \quad (8)$$

where $\mathrm{REquity}_{i,t}$ is return on equity, $\mathrm{Lev}_{i,t}$ is leverage, $\mathrm{g}_{i,t} \equiv EPS_{t+1} - EPS_t$ and $\mathrm{PriceVol}_{i,t}$ is the stock price volatility. We control for industry fixed effects. Our results contradict Cho's (1998) finding that the ownership structure does not affect the corporate value after controlling for endogeneity. Panel A of table (11) shows the results from equation (7), where four different measures of P/E ratio were used as dependent variables, controlling for earnings growth, size, and leverage. Coefficients on OC are negative for three P/E measures as predicted and for the most part highly significant. Panel B of table (11) focuses on the reverse relationship, where OC is the dependent variable. Trailing, Shiller, and forward P/E ratios have negative and highly significant coefficients. We find a strong and robust relationship in which corporate value has an effect on ownership concentration and vice versa. The relationship is simultaneous and reciprocal.

We also perform an instrumental variables regression, where we instrument for the ownership structure with a number of proxies: the number of analyst forecasts from I/B/E/S, the lagged value of OC, and share turnover. Bennett, Sias, and Starks (2003) demonstrate there is a 22% correlation between total institutional ownership and share turnover, which suggests the turnover to be a good instrument. Hartzell and Starks (2003) also use it to instrument for the institutional ownership. The amount of analyst coverage is known to be correlated with the ownership structure. Large amount of analyst coverage will result in certain shifts in ownership concentration as it will attract certain types of investors (e.g. mostly small investors without the apparatus to perform due diligence of a potential investment on their own).

Panel A of table (12) presents results of the instrumental variables regression with the number of earnings forecasts as an instrument. Ownership concentration remains very strongly correlated with the P/E ratio which further confirms the robustness of our results.

Coefficients on OC are negative and significant at 1% level for Shiller's P/E and forward P/E. The p-value for the unlevered P/E coefficient is at little over 10%. Similarly, return on equity is negatively related to the P/E ratio. We also use the number of institutional owners as a measure of the ownership concentration and find it to be positively related to the P/E ratio, after controlling for endogeneity.

Panel B of table (12) demonstrates results when we use the share turnover to instrument for institutional ownership structure. Results remain qualitatively unchanged from the upper panel: more dispersion in the shareholder structure (lower concentration or higher number of institutional owners) increases company valuation.

3.8 First differences estimation

To control for possible omitted variable bias and the resulting endogeneity, we perform the following first difference estimation:

$$\Delta \left(\frac{P}{E}\right)_{i,t} = a + b\Delta OC_{i,t} + controls + \varepsilon_{i,t}, \tag{9}$$

where the controls are the same as in table (3). Table (13) presents the results of this estimation. We only show the coefficient on the measure of ownership concentration and do not report other coefficients. The coefficients on OC are not significant for the 12-month trailing and the unlevered P/E ratios but become negative for the Shiller P/E and highly significant for forward P/E. This is consistent with the results in table (3). We also report results for the number of institutional investors as an alternative measure of the ownership concentration. All coefficients are positive and significant for all but the 12-month trailing P/E ratio. We conclude that the effect of ownership concentration on the firm valuation seems to be robust to any time-invariant omitted variables.

3.9 Managers' Perspective: Required Return and Managerial Discretion

It is costly and impractical for dispersed shareholders to control managers. Managers who enjoy discretion would show less conservative management and less risk averse behavior. Particularly, they would tend to "empire building," i.e., invest in fixed assets at a higher rate, hold less cash as a safety buffer for eventual stockholders' claims, and reveal a more aggressive operational strategy (higher capital and R&D expenditures).

Table (14) shows results of regressions of managerial discretion proxies[5] on ownership concentration and controls. We find strong evidence that managers of companies with more concentrated ownership show structural risk aversion: they are prone to invest less in fixed assets and hold more cash. We include capital expenditures and R&D as two alternative measures of managerial discretion.[6] Evidence when we use ratios of capital expenditures and R&D to net income as managerial discretion proxies is consistent with the previous two measures. Higher ownership concentration leads to a lower fraction of net income spent on R&D, consistent with managers' higher risk aversion with less dispersed shareholder structure. In all regressions we control for stock and debt issuance. All effects are present even with the infusion of more cash as stock or debt are issued. As expected, there is a positive relationship between the amount of cash raised through security issuance and our managerial proxies: fixed asset growth is financed with both debt and equity, capital expenditures are financed primarily through debt issuance. Further, we include the ratio of dividends to net income as a control variable.

Even though the contemporaneous effect of the ownership concentration on capital expenditures as a fraction of net income is not consistent with the Arrow-Lind theorem, the coefficient on the lagged ownership concentration is negative. This suggests that a high ownership concentration predicts low capital expenditures. This result may be explained by the time-to-build feature of capital investments. Some of today's capital expenditures may be related to investment decisions taken in previous periods.

Regression results of managerial discretion proxies by ownership concentration quintiles are shown in panel A and by periods of time in panel B of table (15). Fixed assets growth is negatively correlated with ownership concentration in all but the top quintile and for all periods. When disentangled by pre-crisis (2004-2007) and post-crisis (2008-2011), this relationship vanishes: coefficients are close to zero and non-significant. Cash holdings are negatively correlated with ownership concentration measured by OC at all quintiles and for all analyzed periods but pre-crisis bonanza years 2004-2007.

[5] See Appendix A for a description of managerial discretion proxies.

[6] We also tested the effect of the ownership concentration on the acid ratio (current assets to current liabilities) and short term to long term debt ratio. Managers' overall operational risk aversion, measured by the acid test ratio and short/long-term debt structure, has no correlation with ownership concentration.

In unreported regressions, we also tested the relationship between ownership concentration and operational risk, instrumented by two variables: acid test and short-term to long-term debt. Our results suggest that managers in companies with concentrated ownership are structurally conservative, but ambiguously operationally risk averse. A plausible explanation is that managers have (tacit) consent to take operational risky positions as these are easily reversible in case of distress.

4 Concluding Remarks

The findings presented in this article show that firms' value proxied by several widely used valuation measures is positively correlated with ownership dispersion, across all quintiles of ownership concentration and sample periods, as predicted by Arrow and Lind's (1970) theorem. Managers know investors with small stakes in the company are less risk averse. Consequently, they increase fixed assets in the company through the investment process more rapidly and hold less idle cash. Our findings are robust to numerous different model specifications. We verify that our results are not driven by liquidity or governance effects. Further, we allow the endogeneity between the firm value and ownership concentration. To circumvent the possible time invariant omitted variable problem, we apply the first differences specification. The results survive all these additional tests.

The analysis in this article suggests that valuation models can be enhanced by incorporating measures of ownership concentration. This has certain policy implications. For example, exchange commissions and supervisory agencies should foster real-time filings of the data on stock holdings. Wide availability of stock holding and ownership concentration data will substantially contribute to improving market efficiency and transparency.

Appendix A Definitions

The **Herfindahl-Hirschman Index** is a measure of concentration widely used in industrial organization, competition law and antitrust, and technology management. It is defined as the sum of the squares of the market shares over firms within the industry, where the market shares are expressed as fractions. The result is proportional to the average market share, weighted by market share. It ranges from 0 (for a a huge number of very small firms) to 1 (a single monopolistic producer). Increases in the Herfindahl-Hirschman Index generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite. We used the Herfindahl-Hirschman Index defined as:

$$\mathrm{HHI}_{i,t} = \sum_{j=1}^{N_{i,t}} s_{i,t,j}^2, \tag{10}$$

where $N_{i,t}$ is the number of owners of company i's shares at time t and $s_{i,t,j}^2$ is the percentage ownership in company i at time t of the owner j, to measure ownership concentration. The inverse of HHI gives the hypothetical number of shareholders in the firm provided all had equal number of shares.

We use four measures of **P/E ratio**:[7]

1. *Twelve-Month Trailing P/E ratio* is defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent twelve-month (four-quarter) period. It is the one most often cited in newspapers and other stock tables. This measure of earnings has the disadvantage of looking backward while the stock market is often looking forward, trying to predict future trends.

2. *Unlevered P/E ratio* is calculated with formula:

$$\left(\frac{P}{E}\right)_{unlev} = \frac{\text{Market Capitalization}_{i,t}/(1 - D_{i,t}/(D_{i,t} + E_{i,t}))}{\sum_{j=0}^{11}(\text{Earnings}_{i,t-j} + \text{Interest Expense}_{i,t-j})} \tag{11}$$

   Since P/E is higher when the firm has lower leverage, to ensure that P/E ratios of companies with different leverage are comparable analysts often calculate unlevered P/E ratio, which adjusts P/E ratios by undoing the effect of leverage (Leibowitz 2002).

[7] We thank Denys Glushkov from WRDS for providing the extensive procedure for calculating the P/E ratios in SAS.

3. The *Shiller P/E ratio*, aka Cyclically-Adjusted Price Earnings Ratio (CAPE) or Normalized P/E Ratio (Shiller 2005), is a long-term version of P/E, which is calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior long-run (e.g., ten-year) trailing mean of inflation-adjusted earnings. The main reason behind the use of this measure is that it smoothes out the extreme peaks and valleys in earnings, giving a better framework for thinking about future earnings power. For example, the Shiller P/E ratio is less susceptible to being thrown out of line by the depressed earnings that are sometimes reported as the economy is emerging from a recession.

4. *Forward P/E ratio* uses consensus analyst forecast of earnings over the next year instead of net income. The primary advantage of this P/E version is that it, arguably, does a better job aligning the price (the discounted value of future income stream) with the forward-looking measure of earnings (such as analyst consensus forecast) as opposed to backward-looking, already reported, earnings that are no guarantee for the future earnings. This measure, however, may be sensitive to analyst forecasts bias (Das, Levine, and Sivaramakrishnan 1998) and analyst herding (Trueman 1994).

We use four proxies of **managerial discretion**:

1. *Fixed assets growth* measures the percentage increase in gross value of plant, property, and equipment, i.e., the manager's propensity for "empire building"

$$\text{Fixed Assets growth}_{i,t} = \frac{\text{Fixed Assets}_{i,t} - \text{Fixed Assets}_{i,t-1}}{\text{Fixed Assets}_{i,t-1}} \tag{12}$$

2. *Cash holdings* over assets measures the company's safety cushion

$$\text{Cash holdings}_{i,t} = \frac{\text{Cash}_{i,t}}{\text{Assets}_{i,t}} \tag{13}$$

3. *Capex*, Compustat's capital expenditures, defined as any investment increasing the value of firm's assets. We use the ratio of capital expenditure to net income in our empirical specification.

4. *R&D*, Compustat's research and development expense to net income.

References

Amihud, Y. and H. Mendelson (1989). The effects of beta, bid-ask spread, residual risk, and size on stock returns. *Journal of Finance 44*(2), pp. 479–486.

Arrow, K. and R. Lind (1970). Uncertainty and the evaluation of public investment decisions. *American Economic Review 60*, 364–378.

Bennett, J. A., R. W. Sias, and L. T. Starks (2003). Greener pastures and the impact of dynamic institutional preferences. *Review of Financial Studies 16*(4), 1203–1238.

Chen, J., H. Hong, and J. C. Stein (2002). Breadth of ownership and stock returns. *Journal of Financial Economics 66*, 171–205.

Cho, M.-H. (1998). Ownership structure, investment, and the corporate value: An empirical analysis. *Journal of Financial Economics 47*(1), 103–121.

Das, S., C. B. Levine, and K. Sivaramakrishnan (1998). Earnings predictability and bias in analysts' earnings forecasts. *Accounting Review 73*(2), 277–294.

Davidson, R. and J. G. MacKinnon (1993). *Estimation and Inference in Econometrics*. Oxford University Press.

Demsetz, H. (1968). The cost of transaction. *Journal of Political Economy 82*, 33–53.

Demsetz, H. and K. Lehn (1985). The structure of corporate ownership: Causes and consequences. *Journal of Political Economy 93*(6), 1155–1177.

Fisher, A. (1973). Environmental externalities and the Arrow-Lind public investment theorem. *American Economic Review 73*, 722–725.

Gompers, P., J. Ishii, and A. Metrick (2003). Corporate governance and equity prices. *Quarterly Journal of Economics 118*(1), 107–156.

Hartzell, J. C. and L. T. Starks (2003). Institutional investors and executive compensation. *Journal of Finance 58*(6), 2351–2374.

Leibowitz, M. L. (2002). The levered P/E ratio. *Financial Analysts Journal 58*(6), 68–77.

Morck, R., A. Shleifer, and R. W. Vishny (1988). Management ownership and market valuation. *Journal of Financial Economics 20*, 293–315.

Pastor, L. and R. F. Stambaugh (2003). Liquidity risk and expected stock returns. *Journal of Political Economy 111*(3), pp. 642–685.

Shiller, R. J. (2005). *Irrational Exuberance* (2nd. ed.). Princeton University Press.

Trueman, B. (1994). Analyst forecasts and herding behavior. *Review of Financial Studies 7*(1), 97–124.

Figure 2: This figure presents general trends in the median institutional ownership as % of the company, median ownership concentration calculated as the Herfindahl index, median number of institutional investors, and median holding size per institutional investor. All statistics are computed as firm-level averages.

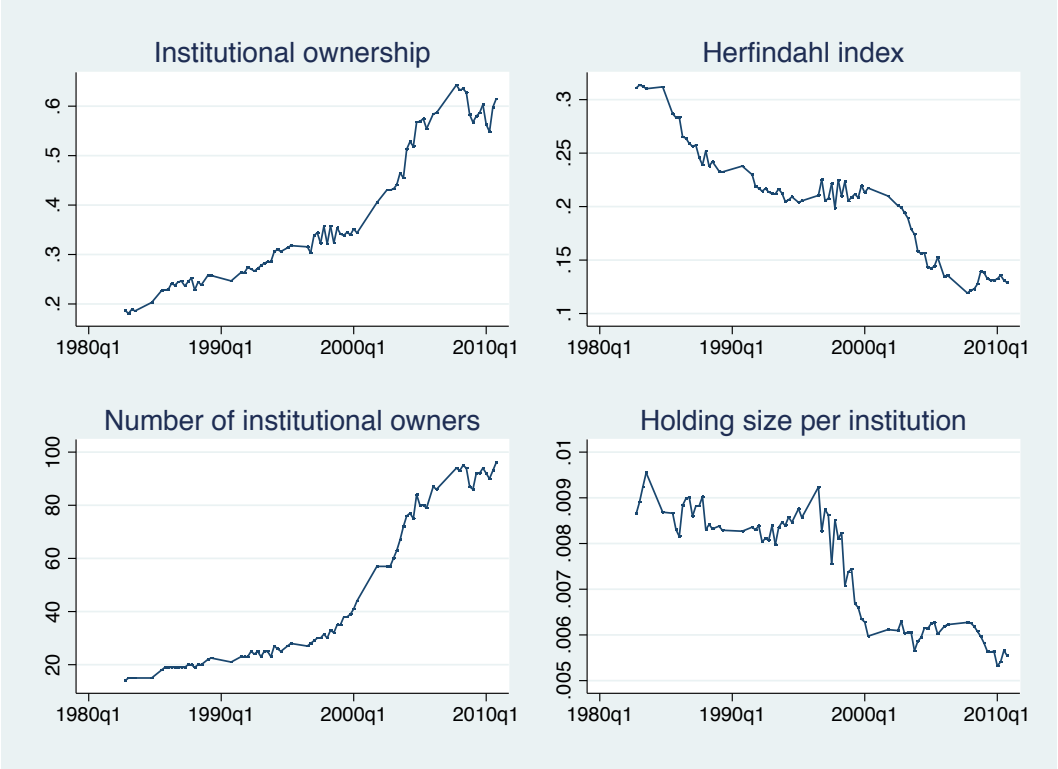
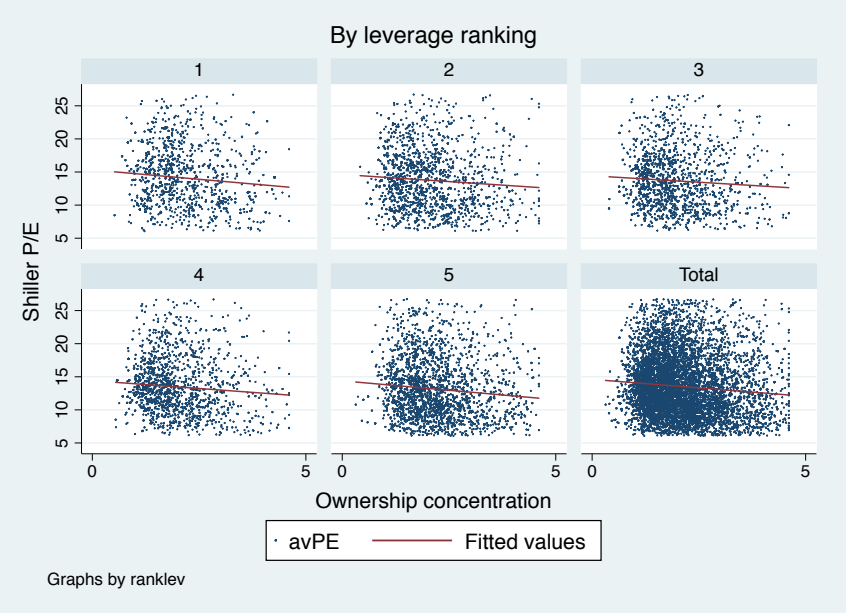


Figure 3: This figure presents the relationship between the ownership concentration and firm valuation, by leverage ranking. Each quarter firms are ranked into quintiles by their leverage defined as total debt over total assets. Each dot in the graph represents a time-series average of the P/E ratio. The firms are classified into leverage quintiles at the end of each quarter and then averages in the time dimensions are calculated. Red lines present a simple linear fit minimizing the sum of least squares of the deviations. Shiller's 10-year P/E ratio is used as a measure of the company valuation.



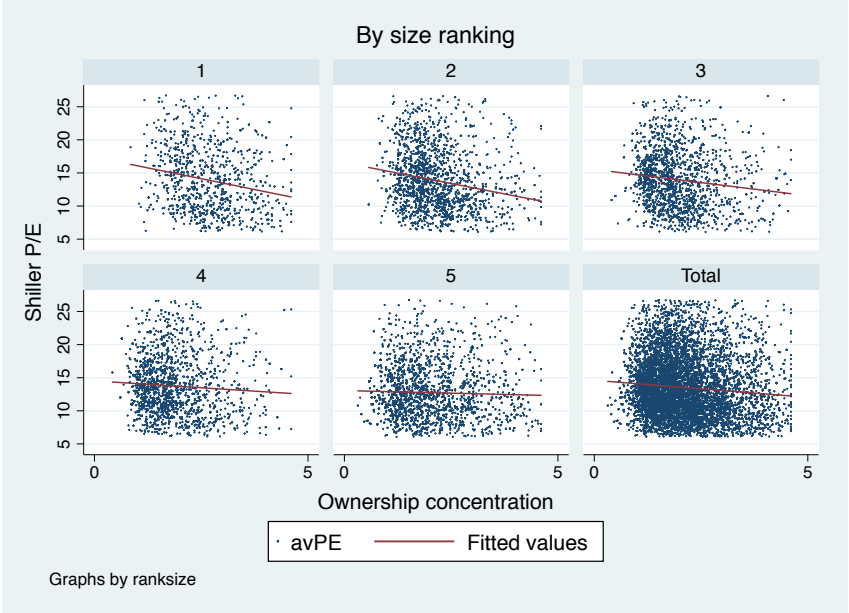


Table 1: This table summary statistics of P/E measures, ownership concentration, managerial discretion, institutional ownership, and controls. We use four measures of the P/E ratio: 1) twelve-month trailing P/E ratio, defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent 12-month (four-quarter) period; 2) unlevered P/E ratio; 3) the Shiller P/E ratio, aka Cyclically-Adjusted Price Earnings ratio (CAPE) or Normalized P/E ratio, calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior ten-year trailing mean of inflation-adjusted earnings; 4) "Forward" P/E ratio, using I/B/E/S consensus analyst forecast of earnings over the next year instead of net income. Cash holdings are measured over assets. Return on equity is given as $r_E = r_f + \beta_E(\mathbf{E}r_m - r_f)$, where β_E is the monthly beta, r_m is a monthly return on S&P500, and r_f is one-month Treasury bill rate. HHI is the Herfindahl-Hirschman Index of institutional ownership. Top five voting power is a dummy variable equal to one if the five largest institutional owners have over 50% of outstanding shares. Top ten voting power is defined analogously. Data is from Thomson Reuters. Sample period is 1980-2012, with quarterly data winsorized at 1% level.

Summary Statistics

Variable	Mean	St.dev.	Min	Max	N
Trailing P/E	11.79	12.02	-14.80	38.93	99496
Unlevered P/E	12.96	11.24	-12.66	39.20	97880
Shiller P/E	18.36	16.97	-18.57	61.67	63055
Forward P/E	14.17	5.36	3.06	28.71	80326
Fixed assets growth	0.02	0.02	-0.02	0.08	46991
Cash	0.01	0.03	0	0.13	120940
Acid ratio	1.76	0.97	0.63	4.92	100258
Short/long-term debt	0.29	0.37	0	1.84	79420
R&D	0.04	0.05	0	0.31	1978
Capex	0.04	0.05	0	0.26	24836
HHI	0.18	0.21	0.01	1.00	133806
Inst. ownership	0.41	0.28	0	1	133806
Number of inst. owners	48.00	78.15	1	1346	133806
Top five voting power	0.02	0.12	0	1	133806
Top ten voting power	0.10	0.29	0	1	133806
Assets	3694.93	18998.81	0	846988	131248
Leverage	0.22	0.39	0	100	125957
Equity beta	1.10	0.53	0.20	2.37	107001
Return on equity	0.20	0.33	-0.51	1.00	107209

Table 2: This table presents the breakdown of the firms in the sample by their two-digit SIC code. We include the total market value (in million US dollars) in any given SIC code, calculated as the sum of average firm-level market values at the end of each quarter in the sample. We also include the number of distinct firms in each two-digit code.

SIC	Market value	Cumulative %	No. of firms	Cumulative %	Sector
73	1,105,211	10.83%	791	14.85%	Prepackaged Software, Computer Systems
28	1,675,576	27.26%	565	25.46%	Pharmaceutical, Biological Products
36	696,524	34.08%	478	34.43%	Electronic Except Computer Equipment
38	409,725	38.10%	403	41.99%	Measuring, Analyzing, And Controlling Instruments
35	521,574	43.21%	349	48.55%	Industrial And Commercial Machinery
13	862,523	51.67%	257	53.37%	Oil And Gas Extraction
48	852,826	60.02%	219	57.48%	Communications
49	631,808	66.22%	205	61.33%	Electric, Gas, And Sanitary Services
50	60,675	66.81%	133	63.83%	Wholesale Trade-durable Goods
80	82,950	67.62%	121	66.10%	Medical Laboratories,Home Health Care Services
87	48,959	68.10%	116	68.27%	Engineering, Accounting, Research, Management
37	361,411	71.65%	103	70.21%	Transportation Equipment
20	360,285	75.18%	102	72.12%	Food And Kindred Products
10	260,012	77.73%	92	73.85%	Metal Mining
59	138,259	79.08%	89	75.52%	Miscellaneous Retail
58	115,250	80.21%	86	77.14%	Eating And Drinking Places
33	102,469	81.22%	80	78.64%	Primary Metal Industries
51	81,537	82.01%	69	79.93%	Wholesale Trade-non-durable Goods
34	51,645	82.52%	66	81.17%	Fabricated Metal Products
30	28,814	82.80%	66	82.41%	Rubber And Plastics Products
27	64,785	83.44%	54	83.42%	Printing, and Publishing
79	45,795	83.89%	52	84.40%	Amusement And Recreation Services
26	128,423	85.15%	52	85.38%	Paper And Allied Products
Other	1,515,459	100.00%	779	100.00%	
	10,202,497		**5,327**		

Table 3: This table presents panel data regressions of four measures of P/E ratio on ownership concentration and controls. We use four measures of the P/E ratio: 1) twelve-month trailing P/E ratio, defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent 12-month (four-quarter) period; 2) unlevered P/E ratio; 3) the Shiller P/E ratio, aka Cyclically-Adjusted Price Earnings ratio (CAPE) or Normalized P/E ratio, calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior ten-year trailing mean of inflation-adjusted earnings; 4) "Forward" P/E ratio, using I/B/E/S consensus analyst forecast of earnings over the next year instead of net income. Ownership concentration is log(HHI), where HHI is the Herfindahl-Hirschman Index of ownership concentration. Controls include: return on equity is given as $R_E = r_f + \beta_E(r_m - r_f)$, where β_E is the annual beta, r_m is annualized return on S&P500, and r_f is one-month Treasury bill rate, natural logarithm of firm's assets, and earnings growth up to three periods ahead defined as $\Delta EPS_{t+n} = EPS_{t+n}/EPS_{t+n-1}$, where $n = 1, 2, 3$. We only report the coefficient on EPS_{t+1}. Data are from Thomson Reuters. Sample period is 1980-2012. We include year and industry level fixed effects. In this and subsequent tables, standard errors are in parenthesis; * denotes significance at 10%, ** significance at 5%, and *** significance at 1%.

Firm Valuation Measures

	Trailing	Unlevered	Shiller	Forward
Ownership concentration	-4.30***	-4.00***	–7.39***	-1.97***
	(-17.63)	(-17.01)	(-15.35)	(-15.98)
Ln(assets)	1.09***	1.71***	1.54***	0.19*
	(6.78)	(10.63)	(4.42)	(2.03)
Leverage	-1.79***	-1.02**	-2.42***	-1.42***
	(-4.54)	(-2.62)	(-4.04)	(-3.70)
Return on equity	-8.65***	-12.04***	-14.59***	-6.55***
	(-4.20)	(-6.17)	(-4.22)	(-7.19)
Earnings growth	-0.01	-0.02	0.00	0.00
	(-1.33)	(-1.75)	(0.27)	(0.39)
Return on assets	-0.00	-0.01	1.24	12.27***
	(-0.20)	(-0.37)	(1.56)	(15.12)
Observations	87749	87343	58158	70901
Overall R^2	0.03	0.04	0.04	0.07

Table 4: This table presents results of the regressions in table (3) for several alternative measures of the ownership structure: number of institutional owners, institutional ownership (%), an indicator variable equal to one if top five shareholders have voting power (top five voting power), top ten voting power defined analogously, percentage ownership of the largest ten and five shareholders. Year and industry fixed effects were included in all regressions. Control variables are the same as in table (3). R^2 are not reported and remain close to those in table (3). The last column present the correlation coefficient with OC.

Alternative Ownership Concentration Measures

	Trailing	Unlevered	Shiller	Forward	Correlation
Number of inst. owners	0.01***	0.01***	0.02***	0.00**	-0.61
	(7.49)	(6.89)	(5.27)	(3.28)	
Inst. ownership (%)	0.11	0.11	11.12***	0.03	-0.72
	(1.22)	(1.24)	(7.70)	(0.69)	
Top five voting power	-1.77	-2.09*	0.09	0.74	0.07
	(-1.73)	(-2.15)	(0.05)	(1.57)	
Top ten voting power	-1.03*	-0.49	-4.20***	0.48*	-0.10
	(-2.24)	(-1.12)	(-5.36)	(2.39)	
Top 5 ownership (%)	-0.04	-0.03	-0.66	-0.02	-0.34
	(-0.38)	(-0.37)	(-0.29)	(-0.53)	
Top 10 ownership (%)	-0.01	-0.01	1.49	-0.01	-0.48
	(-0.10)	(-0.07)	(0.76)	(-0.28)	

Table 5: This table presents P/E regressions on ownership concentration, broken down by ownership concentration quintiles denoted by (1)-(5) in Panel A and by periods: 1980s, 1990s, 2000s, 2004-2007, and 2008-2012 in Panel B. Dependent variables are P/E ratios. We only present the coefficient on the ownership concentration (calculated as log(HHI)). Not reported controls as in table (3). We include year and industry effects. Data are quarterly from Thomson Reuters.

Panel A: Firm Valuation Measures by Quintiles of OC

	(1)	(2)	(3)	(4)	(5)
Trailing P/E	-49.48	-36.54	-36.64**	-5.60	-2.20
	(-1.85)	(-1.43)	(-2.60)	(-0.68)	(-1.22)
Observations	3841	3841	3841	3841	3841
Overall R^2	0.15	0.12	0.10	0.13	0.11
Unlevered P/E	-43.38	-49.79*	-24.27*	6.04	-1.24
	(-1.89)	(-2.45)	(-2.12)	(0.98)	(-0.78)
Observations	3912	3912	3912	3912	3912
Overall R^2	0.21	0.19	0.16	0.16	0.12
Shiller P/E	-169.28***	-170.81***	-99.51***	-20.26	1.27
	(-4.34)	(-4.89)	(-4.77)	(-1.76)	(0.38)
Observations	2661	2661	2661	2661	2661
Overall R^2	0.24	0.18	0.19	0.20	0.26
Forward P/E	10.36	-15.51	-1.09	-0.39	-1.95
	(0.96)	(-1.43)	(-0.18)	(-0.10)	(-1.58)
Observations	3835	3835	3835	3835	3835
Overall R^2	0.28	0.24	0.21	0.23	0.26
Year effects	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes

Panel B: Firm Valuation Measures by Periods

	1980s	1990s	2000s	2004-2007	2008-2011
Trailing P/E	-3.73***	-10.41***	-9.30***	-9.50***	-9.74***
	(-2.62)	(-6.58)	(-7.33)	(-4.32)	(-4.17)
Observations	2048	4373	8158	3042	2700
Overall R^2	0.10	0.12	0.11	0.11	0.14
Unlevered P/E	-4.39***	-5.45***	-7.62***	-8.20***	-7.91***
	(-3.84)	(-4.05)	(-6.77)	(-4.25)	(-3.76)
Observations	2020	4355	8027	2997	2641
Overall R^2	0.16	0.15	0.15	0.15	0.20
Shiller P/E	-17.16**	-13.81***	-18.28***	-16.24***	-15.28***
	(-2.93)	(-4.81)	(-9.08)	(-4.68)	(-3.92)
Observations	348	2556	5199	1969	1780
Overall R^2	0.38	0.21	0.20	0.20	0.22
Forward P/E	-0.27	-1.58	-3.21***	-0.71	-3.10*
	(-0.39)	(-1.76)	(-4.21)	(-0.60)	(-2.37)
Observations	1764	3586	6866	2649	2303
Overall R^2	0.33	0.22	0.17	0.23	0.17
Year effects	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes

Table 6: This table presents main determinants of the demand of institutional investors for stock. As exogenous variables we use measures of size (assets) and liquidity (turnover and stock price volatility), which were shown in the literature to be the main drivers of institutional demand for stocks. Turnover is computed as the monthly trading volume over the common shares outstanding at the end of the quarter. Stock price volatility is calculated on a rolling basis over a 36-month window. "HHI" is Herfindahl index, "No. of owners" is the number of institutional owners, "Ownership (%)" is institutional ownership as a percentage of shares outstanding, and "Voting power" is a dummy equal to one if top five institutional investors hold over 50% of shares.

	Institutional Demand			
	HHI	No. of owners	Ownership (%)	Voting power
Turnover	-0.00***	0.00**	0.00	-0.00
	(-4.21)	(2.79)	(1.72)	(-0.92)
Price volatility	-0.00***	0.95***	-0.00	-0.00*
	(-3.47)	(13.47)	(-0.35)	(-2.10)
Assets	-0.28***	50.20***	0.07***	-0.00***
	(-50.67)	(58.09)	(36.12)	(-3.34)
Constant	4.27***	21.62	-0.06	0.03
	(16.36)	(0.53)	(-0.54)	(0.55)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Observations	21121	21121	21066	21046
Overall R^2	0.54	0.57	0.34	0.04

Table 7: This table presents results from panel data regressions of the P/E ratios on the residual from regressions in table (6). All other controls are defined as in table (3). We do not include the return on equity among the control variables. Year and industry effects are included. Data are quarterly from Thomson Reuters and cover 1980-2012.

Liquidity Residuals				
	Trailing	Unlevered	Shiller	Forward
OC residual	-5.29***	-4.31***	-10.15***	-2.28***
	(-6.90)	(-5.99)	(-8.77)	(-6.47)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Observations	16935	16844	15226	13732
Overall R^2	0.03	0.04	0.05	0.06
No. of owners residual	0.01	0.01**	0.01	-0.01**
	(1.63)	(2.73)	(1.43)	(-2.60)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Observations	16935	16844	15226	13732
Overall R^2	0.03	0.04	0.04	0.06

Table 8: This table presents the summary statistics of ownership concentration defined as $OC = \log(HHI)$, governance index of Gompers, Ishii, and Metrick (2003) denoted by G, and controls by ownership rank. As controls we use leverage, size, growth rate of earnings, and year and industry dummies. Panel data regressions are run on the sample of quarterly data from 1990 to 2006.

Summary Statistics of Ownership Concentration, Governance Index, and Controls by Ownership Concentration Rank

Concentration rank	Mean						N
	HHI	Ln(atq)	G	Leverage	GAgrowth	Cash	Total
1	0.03	8.18	9.45	0.22	0.02	0.04	1170.00
2	0.04	7.55	9.36	0.21	0.02	0.07	1172.00
3	0.04	7.46	9.18	0.23	0.01	0.07	1169.00
4	0.06	7.25	8.94	0.23	0.02	0.09	1175.00
5	0.09	6.81	8.55	0.24	0.01	0.05	1169.00
Total	0.05	7.45	9.09	0.23	0.02	0.07	5855.00

Table 9: This table presents results from panel data regressions of ownership concentration OC defined as $OC = \log(HHI)$ and the number of institutional owners on Governance Index of Gompers, Ishii, and Metrick (2003) denoted by G. As controls we use leverage, size, growth rate of earnings, and year and industry dummies. Panel data regressions are run on the sample of quarterly data from 1990 to 2006.

Governance Index Effect on Ownership Concentration

	HHI	No. of owners	HHI	No. of owners	HHI	No. of owners
Governance index G	-0.01**	-1.35	-0.04***	-4.06	-0.00	12.48
	(-3.01)	(-1.34)	(-3.95)	(-1.83)	(-0.09)	(1.20)
Turnover			-0.00**	0.00***	-0.00**	0.00***
			(-3.15)	(3.99)	(-3.19)	(3.89)
Price volatility			0.00	0.14	0.00	0.21
			(0.50)	(0.38)	(0.62)	(0.56)
G x size					-0.00	-2.01
					(-0.74)	(-1.62)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4639	4639	984	984	984	984
Overall R^2	0.19	0.65	0.41	0.78	0.41	0.78

Table 10: This table presents results from panel data regressions of the four measures of P/E ratio on ownership concentration OC defined as $OC = \log(HHI)$ and Governance Index of Gompers, Ishii, and Metrick (2003) denoted by G. G is transformed and calculated as 24-G. As controls we use leverage, size, past growth rate of earnings, and year and industry dummies. Panel data regressions are run on the sample of quarterly data from 1990 to 2006.

Governance Index Effect on Company Valuation

	Trailing	Unlevered	Shiller	Forward	Trailing	Unlevered	Shiller	Forward
Ownership concentration	-8.11***	-4.31***	-7.79***	0.26	-6.34	-3.85*	-7.50***	-0.32
	(-4.50)	(-6.49)	(-8.87)	(0.92)	(-1.34)	(-2.52)	(-3.77)	(-0.47)
Governance index G	-0.70	-0.57**	-0.87**	-0.22**	-0.54	-0.08	-1.05	-0.20
	(-1.84)	(-3.18)	(-2.60)	(-3.09)	(-0.62)	(-0.21)	(-1.57)	(-1.31)
Trading volume					-0.00	-0.00	-0.00	-0.00
					(-1.44)	(-1.57)	(-1.68)	(-0.24)
Price volatility					0.02	0.08	0.03	0.03
					(0.20)	(1.60)	(0.31)	(1.28)
Return on equity	-20.54	-22.54**	-22.54**	-6.35*	-98.52*	-50.50***	-15.21	-23.85***
	(-0.99)	(-3.21)	(-3.01)	(-2.25)	(-2.06)	(-3.42)	(-1.01)	(-4.07)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3820	3403	2975	3475	794	720	709	731
Overall R^2	0.05	0.10	0.16	0.19	0.09	0.16	0.22	0.38

Table 11: This table presents results from the first stage of the three-stage least squares regressions. We assume the possibility of an endogenous relationship between the P/E ratio and the Herfindahl-Hirschman index (HHI). The formal representation of the simultaneous equations is presented in equations (7) and (8). We control for industry effects. Data are quarterly from 1980 to 2012.

Simultaneous Equations

	Trailing	Unlevered	Shiller	Forward
main				
Ownership concentration	-16.08*	-17.15**	-9.26	8.45
	(-2.33)	(-2.84)	(-0.86)	(1.62)
Ln(assets)	-3.29	-3.15	0.64	3.25*
	(-1.45)	(-1.56)	(0.19)	(2.35)
Leverage	-0.37	-2.40	-13.59**	-8.35***
	(-0.14)	(-0.66)	(-3.26)	(-3.51)
Earnings growth	-0.00	-0.00	0.01	0.00
	(-0.11)	(-0.13)	(0.56)	(0.49)
Return on equity	-0.49	-1.69	-8.03*	-6.61**
	(-0.20)	(-0.43)	(-2.18)	(-2.87)
Ownership concentration				
Ln(assets)	-0.21***	-0.22***	-0.25***	-0.18***
	(-7.64)	(-6.59)	(-24.06)	(-9.92)
Price volatility	-0.00	0.00	0.00	0.01**
	(-0.12)	(0.01)	(0.29)	(3.08)
Trading volume	0.30	1.05	3.12**	0.97
	(0.16)	(0.65)	(3.16)	(0.70)
P/E, trailing 12 months	-0.06***			
	(-4.36)			
Unlevered P/E, trailing 12 months		-0.04**		
		(-3.22)		
Shiller's Long-Term P/E			-0.02***	
			(-7.58)	
Forward P/E				-0.10***
				(-5.95)
Industry effects	Yes	Yes	Yes	Yes
Observations	14928	14859	13509	12189

Table 12: This table presents results of the second stage of the instrumental variables regression. In Panel A we use analysts' coverage as the instrument for the ownership concentration and in Panel B we use the share turnover defined as monthly trading volume over the common shares outstanding at the end of the quarter. Analysts coverage is defined as the number of analysts' forecasts in a given month and is from I/B/E/S. Data are quarterly from 1980 to 2012.

Panel A: Analysts' Coverage

	Trailing	Unlevered	Shiller	Forward
Ownership concentration	-1.00*	-1.18**	-8.14***	-1.52***
	(-2.56)	(-3.17)	(-12.82)	(-8.44)
Observations	10532	10513	6478	9974
Overall R^2	0.03	0.03	0.09	0.08
Number of inst. owners	0.01	0.03***	0.14***	0.03***
	(1.83)	(3.71)	(12.82)	(9.40)
Observations	10532	10513	6478	9974
Overall R^2	0.03	0.03	.	0.05

Panel B: Share Turnover

	Trailing	Unlevered	Shiller	Forward
Ownership concentration	-1.70	-4.68**	-17.64***	-3.70***
	(-1.02)	(-2.91)	(-4.53)	(-4.79)
Observations	87673	87269	58117	70285
Overall R^2	0.03	0.04	0.03	0.07
Number of inst. owners	0.02	0.06**	0.20***	0.05***
	(1.02)	(2.89)	(4.43)	(4.65)
Observations	87673	87269	58117	70285
Overall R^2	0.03	0.03	0.02	0.04

Table 13: This table presents results from first difference regressions: $\Delta\frac{P}{E} = a + b\Delta OC + controls$. All other controls are defined as in table (3). We only report the coefficient on ΔOC or $\Delta NumInst$, where $NumInst$ is the number of institutional owners. Year effects are included. Data are quarterly from Thomson Reuters and cover 1980-2012.

First Differences Estimators

	Trailing	Unlevered	Shiller	Forward
D.Ownership concentration	3.08	-2.51	-7.36	-3.62*
	(0.44)	(-0.46)	(-0.67)	(-2.10)
Observations	15479	15491	6511	11352
Overall R^2	0.00	0.01	0.00	0.02
D.Number of inst. owners	0.90	0.47	0.23	0.76**
	(0.98)	(0.71)	(0.51)	(3.10)
Observations	15479	15491	6511	11352
Overall R^2	0.01	0.01	0.00	0.00

Table 14: This table presents regressions of managerial discretion proxies on ownership concentration and controls. Dependent variable are gross fixed assets growth, cash holdings over assets, capital expenditures to net income, and R&D to net income. Controls include: natural logarithm of firm's assets, leverage, stock and debt issuance over lagged total assets, dividends over net income, and lagged values of the dependent variables. We include year and industry effects. Data is from Thomson Reuters and Compustat and covers the period 1980-2012.

Managerial Discretion Proxies

	Fixed Assets	Cash	Capex	R&D
Ownership concentration	-0.01***	0.05***	-0.13***	-0.29***
	(-8.19)	(22.33)	(-3.85)	(-6.06)
Stock issuance	0.00***	0.00*	0.00	-0.00
	(4.24)	(2.52)	(0.81)	(-1.79)
Debt issuance	0.00***	0.00*	0.00***	-0.00
	(7.63)	(2.46)	(5.60)	(-0.92)
Dividends	0.00	-0.00***	0.06***	0.02
	(0.02)	(-13.75)	(11.82)	(0.77)
Observations	44418	33703	95599	42286
Overall R^2	0.04	0.15	0.04	0.03

Table 15: This table presents regressions of managerial discretion proxies on ownership concentration, broken down by ownership concentration quintiles denoted by (1)-(5) in Panel A and by periods: 1980s, 1990s, 2000s, 2004-2007, and 2008-2012 in Panel B. Dependent variables are managerial discretion proxies. We only present the coefficient on ownership concentration (OC). Not reported controls as in table (14).

Panel A: Managerial Discretion Proxies by Quintiles of OC

	(1)	(2)	(3)	(4)	(5)
Fixed assets growth	-0.01***	-0.00	-0.01***	-0.01***	0.00
	(-3.47)	(-0.27)	(-2.60)	(-2.87)	(0.09)
Cash	0.03***	0.05***	0.05***	0.02	0.03***
	(7.46)	(5.10)	(4.18)	(1.11)	(2.11)
Capital expenditure	0.01	-0.35	-0.33	0.16	-0.07
	(0.07)	(-1.26)	(-1.27)	(0.75)	(-0.47)
R&D	-0.32	-0.97***	-0.22	-0.01	-0.15
	(-1.13)	(-2.24)	(-0.59)	(-0.02)	(-0.70)

Panel B: Managerial Discretion Proxies by Periods

	1980s	1900s	2000s	2004-2007	2008-2012
Fixed assets growth	-0.02***	-0.01***	-0.01***	-0.01***	-0.00
	(-4.32)	(-5.14)	(-4.73)	(-3.38)	(-0.18)
Cash	0.00	0.00	0.01	0.01**	0.05***
	(0.23)	(0.23)	(1.10)	(1.95)	(21.78)
Capital expenditure	-0.24	-0.08	-0.13*	-0.06	-0.13***
	(-1.48)	(-1.10)	(-1.73)	(-0.90)	(-2.23)
R&D	.	-0.31***	-0.33***	-0.17	-0.29***
	.	(-3.02)	(-2.76)	(-1.34)	(-3.59)